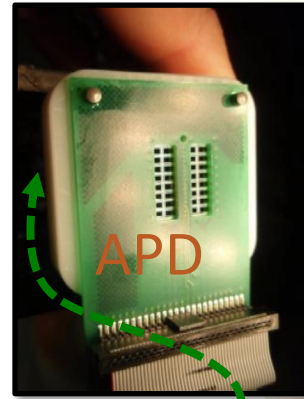


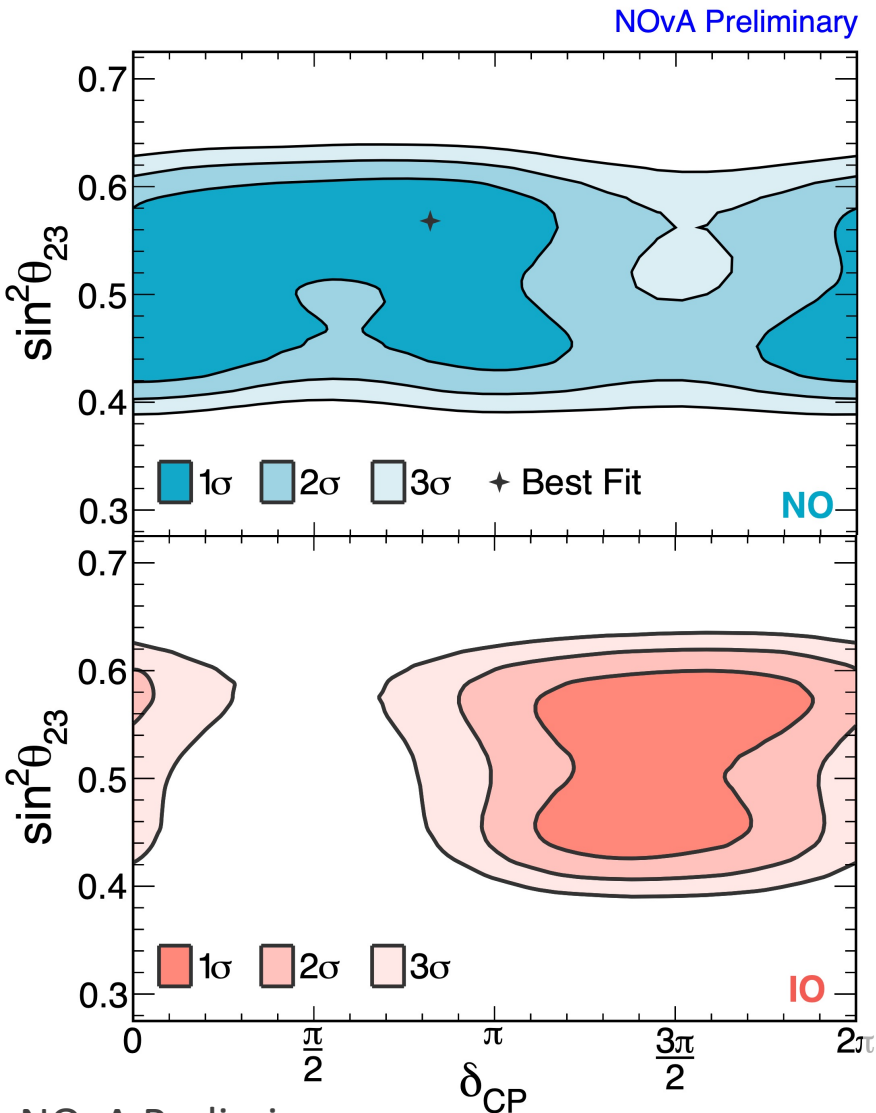
NOvA



- Long-baseline neutrino oscillation experiment
 - ▣ High power/high purity neutrino and antineutrino beams from Fermilab's NuMI facility
 - ▣ At 14 mrad off-axis, energy peaked at 2 GeV
 - ▣ 2 Functionally identical detectors separated by 810 km
 - ▣ ND on site at Fermilab
 - ▣ FD in Ash River, Minnesota
- NOvA addresses many compelling questions surrounding the nature of neutrino mass
 - ▣ What is the Neutrino Mass Hierarchy?
 - ▣ Is there CP symmetry violation in neutrinos?
 - ▣ Is there more to it than 3x3 PMNS?



NOvA Fit Results



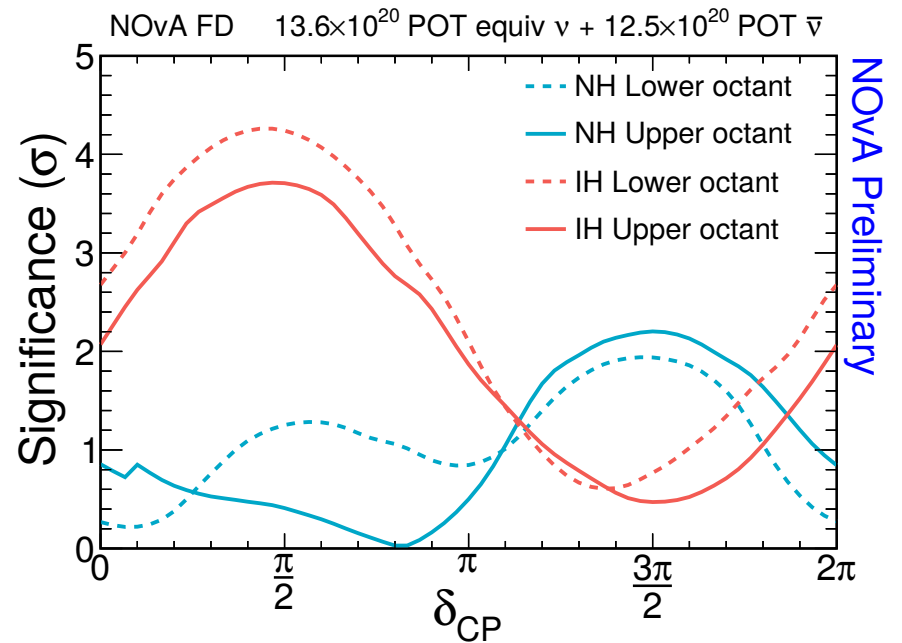
- Best fit in Normal Ordering and Upper Octant

$$\Delta m_{32}^2 = (2.41 \pm 0.07) \times 10^{-3} \text{eV}^2$$

$$\sin^2(\theta_{23}) = 0.57^{+0.03}_{-0.04}$$

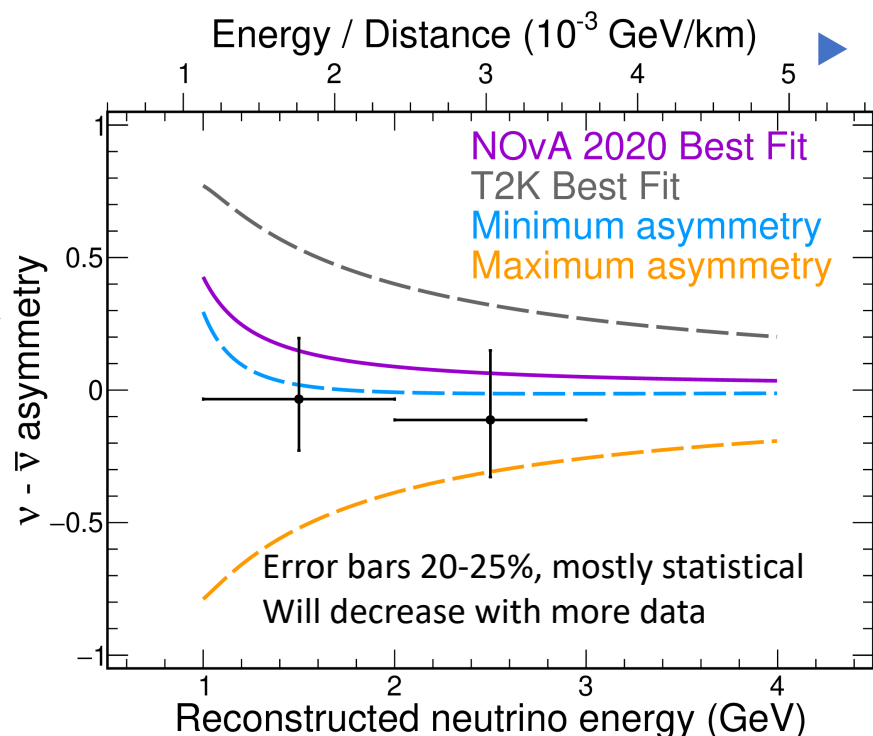
$$\delta_{CP} = 0.82^{+0.27}_{-0.87} \pi$$

- NOvA data is consistent with no asymmetry between electron neutrino and antineutrino appearance probability
 - In this region of phase space, we can not make strong statements on mass ordering, octant, or δ individually
 - We disfavor combinations of oscillation parameters that give large asymmetry (NO, $\delta=3\pi/2$ and IO, $\delta=\pi/2$)
- NOvA will run until long shutdown for LBNF, expected to be through 2026. With beam improvements, we aim to at least double current data set
 - Reach 3 σ sensitivity to the mass ordering for 30-50% of δ values
 - Reduce largest systematics with results from testbeam program



Global context

- World measurements of atmospheric mixing parameters show good agreement
- Some tension between NOvA and T2K appearance results
 - NOvA does not see strong neutrino/antineutrino asymmetry in electron neutrino appearance
 - T2K observes more electron neutrino appearance than electron antineutrino appearance



NOvA and T2K have joined forces on a joint fit

- Different baselines and energies provide complementary information
- Results expected this year

